

CLAIMS

What is claimed is:

- 1 1. A plastic article having a bearing surface, comprising:  
2 a polymeric matrix material; and  
3 a first additive that is a lubricious reinforcing fiber having a thermal  
4 conductivity of at least about 50 W/m°K.
- 1 2. The plastic article of claim 1, wherein the first additive has a tensile strength of at  
2 least about 200 KSI.
- 1 3. The plastic article of claim 1, wherein the first additive has a tensile modulus of at  
2 least about 100 MSI.
- 1 4. The plastic article of claim 1, wherein the first additive has a coefficient of thermal  
2 expansion of about - 1.4 parts per million/°C.
- 1 5. The plastic article of claim 3, wherein the first additive has a density of at least about  
2 density of at least about 2.0 gm/cm<sup>3</sup>.
- 1 6. The plastic article of claim 1, wherein the first additive has a thermal conductivity  
2 ranging from about 200 to about 1000 W/m°K.
- 1 7. The plastic article of claim 1, wherein the first additive has a thermal conductivity  
2 ranging from about 400 to about 800 W/m°K.
- 1 8. The plastic article of claim 1, wherein the article comprises from about 5 percent to  
2 about 70 percent by weight of the first additive, based on the total weight of the article.
- 1 9. The plastic article of claim 1, wherein the article comprises from about 30 percent to  
2 about 60 percent by weight of the first additive, based on the total weight of the article.

1 10. The plastic article of claim 1, wherein the article comprises from about 35 percent to  
2 about 55 percent by weight of the first additive, based on the total weight of the article.

1 11. The plastic article of claim 1, wherein the article comprises a wear factor of less than  
2 about 40 under a load of about 200 psi and a velocity of about 50 feet per minute.

1 12. The plastic article of claim 1, wherein the article comprises a wear factor of less than  
2 about 100 under a load of about 200 psi and a velocity of about 50 feet per minute.

1 13. The plastic article of claim 1, wherein the article comprises a wear factor of less than  
2 about 200 under a load of about 200 psi and a velocity of about 50 feet per minute.

1 14. The plastic article of claim 1, wherein the article comprises a coefficient of friction  
2 of less than about 0.40 under a load of about 200 psi and a velocity of about 50 feet per  
3 minute.

1 15. The plastic article of claim 1, wherein the article comprises a maximum temperature  
2 of less than about 250°F under a load of about 200 psi and a velocity of about 50 feet per  
3 minute.

1 16. The plastic article of claim 1, wherein the article comprises a wear factor of less than  
2 about 40 under a load of about 2000 psi and at a speed of about 50 feet per minute.

1 17. The plastic article of claim 1, wherein the article comprises a wear factor of less than  
2 about 100 when measured under a load of about 200 psi and at a speed of about 500 feet per  
3 minute.

1 18. The plastic article of claim 1, wherein the polymeric matrix material is selected from  
2 the group consisting of polyamideimide, polyetherimide, polyimide, polyetheretherketone,  
3 polyphenylene sulfide, liquid crystal polymer, and combinations thereof.

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2 19. The plastic article of claim 1, wherein the lubricious reinforcing fiber is selected from  
3 the group consisting of Thermalgraph DKD fibers, Thermalgraph DKA fibers, Dialead K223HG fibers, and combinations thereof.

20. The plastic article of claim 1, further comprising a second additive that is lubricious.

1 21. The plastic article of claim 20, wherein the article comprises a wear factor of less than  
2 about 200 under a load of about 200 psi and a velocity of about 50 feet per minute.

1 22. The plastic article of claim 20, wherein the article comprises a wear factor of less than  
2 about 100 under a load of about 200 psi and a velocity of about 50 feet per minute.

1 23. The plastic article of claim 20, wherein the article comprises a wear factor of less than  
2 about 25 under a load of about 200 psi and a velocity of about 50 feet per minute.

1 24. The plastic article of claim 20, wherein the article comprises a coefficient of friction  
2 of less than about 0.40 under a load of about 200 psi and a velocity of about 50 feet per  
3 minute.

1 25. The plastic article of claim 20, wherein the article comprises a maximum temperature  
2 of less than about 250°F under a load of about 200 psi and a velocity of about 50 feet per  
3 minute.

1 26. The plastic article of claim 20, wherein the article comprises a wear factor of less than  
2 about 100 under a load of about 2000 psi and at a speed of about 50 feet per minute.

1 27. The plastic article of claim 20, wherein the article comprises a wear factor of less than  
2 about 250 when measured under a load of about 200 psi and at a speed of about 500 feet per  
3 minute.

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35. The plastic article of claim 34, wherein the first additive is DKD, the second additive is boron nitride platelets, and the polymeric matrix material is selected from the group

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1 40. A plastic article having a bearing surface, comprising:  
2 a polymeric matrix material selected from the group consisting of  
3 polyamideimide, polyetherimide, polyimide, polyetheretherketone, polyphenylene sulfide,  
4 liquid crystal polymer, and combinations thereof; and  
5 about 5 percent to about 75 percent by weight of a first additive selected from  
6 the group consisting of Thermalgraph DKD fibers, Thermalgraph DKA fibers, Diallead  
7 K223HG fibers, and combinations thereof.

8 wherein the plastic article has a wear factor of less than about 200 under a  
9 load of about 200 psi and a velocity of about 50 feet per minute.

1 41. A plastic article having a bearing surface, comprising:  
2 a polymeric matrix material;  
3 about 2 percent to about 75 percent by weight of a first additive having a  
4 density of at least about 2.0 gm/cm<sup>3</sup>; and  
5 about 2 percent to about 75 percent by weight of a second additive,  
6 wherein the plastic article has a wear factor of less than about 200 under a  
7 load of about 200 psi and a velocity of about 50 feet per minute.

1 42. The plastic article of claim 41, wherein the polymeric matrix material is selected from  
2 the group consisting of polyamideimide, polyetherimide, polyimide, polyetheretherketone,  
3 polyphenylene sulfide, liquid crystal polymer, and combinations thereof.

1 43. The plastic article of claim 42, wherein the first additive is selected from the group  
2 consisting of Thermalgraph DKD fibers, Thermalgraph DKA fibers, Dialead K223HG fibers,  
3 and combinations thereof.

1 44. The plastic article of claim 43, wherein the second additive is selected from the group  
2 consisting of boron nitride, carbon, graphite, molybdenum disulfide, talc, tetrafluoroethylene,  
3 and combinations thereof.

1 45. A plastic article having a bearing surface, comprising:  
2 a polymeric matrix material selected from the group consisting of  
3 polyamideimide, polyetherimide, polyimide, polyetheretherketone, polyphenylene sulfide,  
4 liquid crystal polymer, and combinations thereof;  
5 about 2 percent to about 75 percent by weight of a first additive selected from  
6 the group consisting of Thermalgraph DKD fibers, Thermalgraph DKA fibers, Dialead  
7 K223HG fibers, and combinations thereof; and

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11                    wherein the plastic article has a wear factor of less than about 200 under a  
12    load of about 200 psi and a velocity of about 50 feet per minute.

1      47.      The plastic article of claim 46, wherein the second additive is selected from the group  
2      consisting of boron nitride, carbon, graphite, tetrafluorethylene, molybdenum disulfide, talc,  
3      tetrafluoroethylene, and combinations thereof.

1     49.     The plastic article of claim 48, wherein the first additive is a graphitized carbon fiber  
2     having a density of at least about 2.0 gm/cm<sup>3</sup>.

51. The plastic article of claim 49, wherein the second additive is boron nitride platelet.

1 53. The plastic article of claim 48, comprising at least about 5 percent to about 75 percent  
2 by weight of the first additive, based on the total weight of the article.

1 54. The plastic article of claim 53, comprising at least about 2 percent by weight to about  
2 75 percent by weight of the second additive, based on the total weight of the article.

1     55.     The plastic article of claim 48, comprising at least about 2 percent to about 75 percent  
2     by weight of the first additive, and at least about 2 percent to about 75 percent by weight of  
3     the second additive, based on the total weight of the article.

56. The plastic article of claim 48, wherein the polymeric matrix material is selected from the group consisting of polyamideimide, polyetherimide, polyimide, polyetheretherketone, polyphenylene sulfide, liquid crystal polymer, and combinations thereof.

1 57. The plastic article of claim 48, wherein the article comprises a wear factor of less than  
2 about 100 under a load of about 200 psi and a velocity of about 50 feet per minute.

1 58. The plastic article of claim 46, wherein the article comprises a coefficient of friction  
2 of less than about 0.40 under a load of about 200 psi and a velocity of about 50 feet per  
3 minute.

1     59.     The plastic article of claim 46, wherein the article comprises a maximum temperature  
2     of less than about 250°F under a load of about 200 psi and a velocity of about 50 feet per  
3     minute.

1     60.     The plastic article of claim 46, wherein the article comprises a wear factor of less than  
2     about 100 under a load of about 2000 psi and at a speed of about 50 feet per minute.

1     61.     The plastic article of claim 46, wherein the article comprises a wear factor of less than  
2     about 250 when measured under a load of about 200 psi and at a speed of about 500 feet per  
3     minute.

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1 62. The plastic article of claim 46, wherein the lubricious reinforcing first additive  
2 includes a solid lubricant.

1 63. The plastic article of claim 62, wherein the lubricious reinforcement fiber includes a  
2 solid lubricant.

1 64. The plastic article of claim 62, wherein the lubricious reinforcement fiber is coated  
2 with the solid lubricant.

1 65. The plastic article of claim 62, wherein the lubricious reinforcement fiber and the solid  
2 lubricant are unitary.

66. The plastic article of claim 62, wherein the solid lubricant is graphite.

67. The plastic article of claim 63, wherein the solid lubricant is graphite.

68. The plastic article of claim 64, wherein the solid lubricant is graphite.

1 69. The plastic article of claim 46, wherein the article comprises a thermal conductivity  
2 of less than about 10 W/m°K.

1 70. A method of forming a bearing composition comprising the steps of:  
2 forming a solution of a polymeric matrix material and a first additive; and  
3 evaporating the solvent.

1 71. The method of claim 70, further comprising the step of mixing the solution after the  
2 step of forming the solution.

1 72. The method of claim 70, further comprising adding a second additive to the solution  
2 simultaneously with the step of adding the first additive to the solution.

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1 73. The method of claim 71, further comprising adding a second additive to the solution  
2 after the step of forming the solution.

1 74. The method of claim 71, further comprising the step of heating the solution to  
2 evaporate the solvent.

1 75. The method of claim 72, further comprising the step of heating the solution to  
2 evaporate the solvent.

1 76. The method of claim 73, further comprising the step of heating the solution to  
2 evaporate the solvent.

77. The method of claim 70, wherein the first additive is a reinforcement fiber.

1 78. The method of claim 77, wherein the length of the reinforcement fiber before the step  
2 of forming the solution is substantially the same as the length of the reinforcement fiber after  
3 the step of allowing the solvent to evaporate.

1 79. The method of claim 78, wherein the reinforcement fiber has a length of about 200  
2  $\mu\text{m}$ .

1 80. The method of claim 79, wherein the reinforcement fiber has a density of greater than  
2 about 2.0  $\text{gm/cm}_3$ .

1 81. The method of claim 80, wherein the first additive has a thermal conductivity ranging  
2 from about 50  $\text{W/m}^\circ\text{K}$  to about 1500  $\text{W/m}^\circ\text{K}$ .

1 82. An additive for a polymeric matrix material, comprising:  
2 a lubricious reinforcing first additive; and  
3 a lubricious second additive.

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1 83. A plastic article having a bearing surface, comprising:  
2 a polymeric matrix material; and  
3 a first additive that is a lubricious carbon fiber having a thermal conductivity  
4 of at least about 50 W/m°K.

1 84. A plastic article having a bearing surface, comprising:  
2 a polymeric matrix material;  
3 a first additive that is a lubricious carbon fiber having a thermal conductivity  
4 of at least about 50 W/m°K; and  
5 a lubricious second additive.

1 85. A plastic article having a bearing surface, comprising:  
2 a polymeric matrix material;  
3 a first additive that is a lubricious carbon fiber having a thermal conductivity  
4 of at least about 50 W/m°K; and  
5 a lubricious second additive selected from the group consisting of boron  
6 nitride, carbon, graphite, molybdenum disulfide, talc, tetrafluoroethylene, and combinations  
7 thereof.

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